HAROLD SANDON
M.A., Ph.D., Professor of Zoology, University of Khartoum

On University Entrance Qualifications for Students of Biology

OFTEN IN THE past, and especially during this year of centenary celebrations. I have wondered uneasily what we should have made of Charles Darwin had he been one of our students today. Now we have the REVIEW's editorial answer:* "Darwin was a truly late developer. In the modern competition for university places it seems evident that he would have failed. To-day precocity is at a premium."

This conclusion is important, not merely because of our interest in everything concerning Darwin, but even more because in this he was typical of a considerable class of biologists both great and small. "As a schoolboy, and for long as an undergraduate, I was ignorant of my true vocation, and never had sufficient mental enthusiasm for the studies put before me to win any scholarships. . . . A child of working-class parents who, like me, did not succeed in finding his real aim in life until nearly the age of nineteen or twenty, would have little chance of pursuing it." That was written by Joseph Needham, but there are many other eminent biologists who might equally truthfully have written it.

As for the less eminent ones, no doubt every university teacher of these subjects can recall numerous instances among his own students. How often does it happen that in the final years of a course the winner proves to be a dark horse who, throughout his school and early university career, had done no more than just hold his place in the general field among the mediocrities? How often has one had to struggle to press the claims of such a student against incomprehending colleagues of other departments who firmly believe that a man cannot possibly be first-class unless the whole of his career has been marked by an uninterrupted series of brilliant successes? The linguist, the mathematician, the physicist or the chemist almost invariably reveals his special abilities almost from the first day he enters school. So do some biologists, but there is a large class of these who do not. How many of these will be lost entirely if we yield to the rising clamour of the raising of university entrance qualifications, especially in Mathematics and Chemistry?

Yet the terms "late" and "precocious" are misleading. Gregor Mendel failed the State Teachers' Examination for the second time at the age of thirty-four. This was only very shortly before he started that series of experiments which led, only nine years later, to the publication of his *Experiments on Plant Hybridization.* Can we believe that his scientific abilities had been retarded up to the age of thirty-four and then suddenly blossomed out? Or if we compare the "late developer" Darwin with a precocious one such as J. S. Mill, the differences are obviously qualitative ones. The remarkable abilities in languages and mathematics shown by Mill even in infancy did not develop more slowly in Darwin. They simply did not develop at all.

Mental Characteristics of Darwin and Wallace

If we try to define just what are the characteristics which make for the success of the Darwin-Mendel type of biologist, our first impression is that these are marked mainly by negatives. Darwin, by his own admission, was not very quick at learning anything, was singularly incapable of mastering any language, was not able to see any meaning in the early steps of algebra, was not quick-witted enough to hold an argument with anyone, had only a very limited ability to follow a long or purely abstract train of thought and therefore could never have succeeded with metaphysics or mathematics, had an extensive but hazy memory so that he

* EUGENICS REVIEW, July 1958, 50, 2.

had never been able to remember for more than a few days a single date or line of poetry, could neither sing nor draw and, according to his son, regarded a skilful dissection as something almost superhuman. Alfred Russel Wallace's self-analysis is very similar; he did not think that as a young man he could be said to have shown special abilities in any of the higher mental faculties but he records a long list of his defects including an inability to appreciate the niceties of melody and harmony in music, bad verbal memory which, combined with the inability to reproduce vocal sounds, rendered the acquirements of foreign languages very difficult and distasteful, inability as a speaker to find the right words or expressions, a very limited power of drawing or perception of the intricacies of form, and so on. When we ask what there is on the credit side of such balance sheets, all that Darwin could claim was " strong and diversified tastes, much zeal in whatever interests me and keen pleasure in understanding any complex subject or thing" together with "a fair share of invention and of common sense or judgment such as every fairly successful lawyer or doctor must have but not, I believe, in any higher degree". For Wallace it was "a strong desire to know the causes of things, a great love of beauty in form and colour, a considerable but not excessive desire for order and arrangement in whatever I had to do and a power of correct reasoning from a review of known facts in any case to the causes or laws which produced them". These are hardly things which come out in any kind of scholastic test. It appears that motivation is a more decisive characteristic of such men than any special intellectual gifts.

Late Development

This is where late development comes in for it seems characteristic of men of this type that their early interests are wide and diversified and only relatively late converge to a definite point. It is not accidental that a rather large proportion of eminent zoologists started their university studies with some totally different career in view and only switched over to their definitive vocation later on. In the old days, when one went to the university at Father's expense, this did not matter provided that Father was able to afford to pay for the extra years of study. But now, when the great majority of students are educated at the public expense, to change one's course of study mid-way is a luxury that can rarely be permitted. This is a pity, for a university is, above all, a place where one changes one's mind about a lot of things, including for many people their own aims in life. A school-boy enthusiasm for natural history is no indication that a man will make a good biologist, for, unlike Wordsworth's Happy Warrior, he is liable to grow up and, when brought among the tasks of real life he may well find that the plan that pleased his boyish thought made no provision for ambitions which, with maturity, become dominant. We ought to be able to know a student better than he knows himself so as to be able to guide him into a career which will give him permanent satisfaction regardless of his temporary fancies.

Student guidance in under-developed countries

Nowhere is this matter of student guidance more important than in the new universities in what it is customary to call the "under-developed" countries. Many students come to them with very little idea of what a professional scientist is or does. Their choice of curriculum is determined, only too often, by accident or misunderstanding and if, later on, they regret it, there is little that can be done to alter it. If in later life some of these provide examples for cynics who assert that university education merely produces disgruntled, socially undesirable individuals, with no sense of vocation and whose ambitions are simply to have a bigger salary, a more impressive office desk and a smarter car than their neighbours, is this surprising? These are the natural consequences of the circumstances which pushed them into careers which they find, as Wallace found languages, "difficult and distasteful" and could in most cases have been avoided if they had been guided into careers more fitting to their abilities and tastes.

In the biological sciences the problems of student selection and guidance are complicated by the fact that we ourselves do not really know what we want. The change that comes over a class when it passes on from the descriptive

parts of zoology or botany to genetics is a familiar one. The faces of the brightest students —those whose drawings and dissections are impeccable and who can always unhesitatingly remember the correct names of everything— immediately assume a blank look, while it is from some previously very ordinary members of the class that all the answers come, correctly and effortlessly. Which kind of student do we consider the better zoologist or botanist? Or do we rank them both inferior to those who just do moderately well at everything without showing any particular ability at anything? Curricula are usually weighted heavily on one side or the other and fashions change rapidly. Only a generation ago it was quite common to assume that a man could not possibly be considered as a potential zoologist unless he combined artistic skill with the kind of visual memory that would enable him, for instance, to draw a complicated three-dimensional object such as a skull neatly and accurately from memory in an examination. Now-a-days the *pons asinorum* is more likely to be biochemical. Both kinds of test are effective for picking out men whose special gifts are needed for work in particular branches of biology. But they are equally effective in failing some others and it is doubtful if the Darwins, Wallaces and Mendels would manage to cross either of the bridges.

The need for varied abilities

Biology is the most catholic of all disciplines. Men of almost every kind of natural endowment can make their characteristic contributions to it. At the present time there is no doubt that the most exciting advances are in those branches for which expertise in the mathematical and physical sciences is essential and, if this were all, the arguments in favour of raising the qualifications for admission to the courses would be unanswerable. But progress would be very lop-sided and would soon come to a standstill if there were not also a strong body of morphologists, systematists, ecologists and field naturalists. The health of the science depends more than anything else upon the influence of a solid core of men distinguished by their intimate familiarity with and intuitive sympathy for living things.

These varied kinds of work call for men of very varied kinds of abilities which rarely coexist in a single individual. In fact it is quite possible that some of them may be mutually exclusive. Somehow we need to adjust our curricula and examinations in such ways as to enable men of all these different types to make the best of the abilities which they have without being held back on account of those which they lack. How to do this is, at present, much more a matter of guess-work than of knowledge. Research into such problems is urgent for without the understanding of these matters which research alone can give, quite a considerable part of the resources available for higher education in science will continue to be wasted in efforts to fit square pegs into round holes. This is not merely a deplorable waste of money but a potent source of trouble alike to the unfortunate individuals on whom we make our mistakes and to the communities to which they belong.